



Neural networks: Structure and repair
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Part 1:

Ground squirrel visual system

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This project uses the visual system of squirrels, with special emphasis on the retina, to study the normal organization of neural networks. Over the past year we have added to our knowledge of the organization of the retinal ganglion cell layer: 1) We have determined that only 50% of the cells in the ganglion cell layer are retinal ganglion cells. 2) Retinal ganglion cells projecting to the superior colliculus have been identified using Cholera Toxin subunit B (CTB) as a retrograde tracer. The ZIDAS and Neurolucida image analysis systems have been used to characterize the dendritic tree of the medium-sized cells from this group. Differences in the organization of the dendritic tree suggest that these cells comprise more than one subpopulation. 3) Experiments to determine whether retinal ganglion cells project to more than one retinal projection target have revealed that ganglion cells in this species do not project bilaterally to any significant degree.

We have also continued to identify and analyze the distribution of retinal neuroactive substances. Dopaminergic amacrine, displaced amacrine and interplexiform cells have been extensively studied. At present we are also completing a series of experiments on the distribution of somatostatin.

We have also begun experiments using immunohistochemical and double labeling methods to investigate neuroactive substances involved in connections of the superior colliculus with other visual system structures. At present positive results have been obtained with antibodies against somatostatin, glycine and glutamate.

Publications

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Lugo-García, N. and Blanco, R.E. (1993) Dopaminergic neurons in the cone-dominated ground squirrel retina: a light and electron microscopy study. *J. Hirnforsch.* 35:561-569.

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Rivera, N. and Lugo, N. (1994) Retinal ganglion cells that project to the superior colliculus of the ground squirrel: a cholera toxin study. XIV Federative International Congress of Anatomy. (in press).

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Part 2:

Formation, Maintenance and Plasticity of Synaptic Connections

Damien Kuffler

Overview of Scientific Progress of ONR-funded Research over the past year

This research is examining the interactions between neurons and their targets using cultures of adult motor and sensory neurons, as well as the cells of the peripheral nerve tube and intact adult skeletal muscle fibers. We have characterized a number of the electrophysiological membrane properties of the neurons and made comparisons with the properties of similar neurons from a variety of mammalian neurons. This work has resulted in 3 publications. We have found that isolated intact adult muscle fibers, free of their extracellular matrix and the molecule agrin, retain their acetylcholine receptors at the original synaptic sites for more than 4 weeks, contrary to findings for mammalian muscle fibers. We are examining the rates of internalization and turnover of the receptors to determine what factors, other than agrin, such as activity and the protein dystroglycan, are important in controlling the receptor turnover. We have also found that the nuclei of the synaptic region, which are normally clustered, become dispersed within 6 hours of muscle fiber dissociation. We are examining which factors may play a role in the maintenance and dispersion of these nuclei. Experiments to characterize the neurotrophic factor/s released from the cells of the peripheral nerve tube have continued and the results show that they are related to nerve growth factor, work resulting in 2 publications. Experiments continue to examine whether the nerve tube released neurotrophins act to direct process outgrowth of neuronal processes *in vitro*, work resulting in 1 publication.

Publications

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Kuffler, D.P. (1994). How do axons find their targets? *News in Physiological Sciences*. (submitted).

Abstracts

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Kuffler, D.P. (1994). Diffusible factors provide long-distance guidance for neuronal processes. ARO Biosci. Conf., Specific Interactions of Biological Molecules.

Skatchkov, S., C. Broesamle, L. Vyklicky, D.P. Kuffler & R.K. Orkand (1994). NMDA receptors on adult frog spinal motoneurons in culture. Sixth Puerto Rico EPSCoR Ann. Conf. 6:29.

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Broesamle, C. & D.P. Kuffler (1994). Acetylcholine receptors on isolated muscle fibers *in vitro*. Sixth Puerto Rico EPSCoR Ann. Conf. 6:34.

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